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No. 159

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CHINA REPORT

SCIENCE AND TECHNOLOGY

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CONTENTS

PEOPLE'S REPUBLIC OF CHINA

APPLIED SCIENCES

Beijing-Wuhan Microwave Communications Line Being Tested
(Zhou Hongshun; JISUANJI SHIJIE, 5 May 81) 1

DJS 200/XT1 Computer Operating System Described
(Fei Xianglin, Tan Yaoming; JISUANJI SHIJIE, 5 Aug 81) . 4

HAJIF-II Program System Described
(Guan Te; GUOJI HANGKONG, Mar 82) 8

Cable Television Prospects, Applications Described
(Yang Jinxiang; DIANZI KEXUE JISHU, No 2, 1982) 15

Transonic Axial Compressor Test Rig Designed
(Fang Jianshan; GUOJI HANGKONG, No 11, 1981) 26

ABSTRACTS

AUTOMOTIVE ENGINEERING

NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING], No 1, 1982 34

ELECTRONICS

DIANZI SHIJIE [ELECTRONIC WORLD], No 3, 15 Mar 82 37

HYDRAULIC MACHINERY

YEYA YU QIDONG [HYDRAULICS AND PNEUMATICS], No 1, 15 Mar 82 ... 39

MINING AND METALLURGY

ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY], No 4, Dec 81 41

PHYSICS

DIWEN WULI [ACTA PHYSICA TEMPERATURE HUMILIS SINICA], No 1, 1982. 49

APPLIED SCIENCES

BEIJING-WUHAN MICROWAVE COMMUNICATIONS LINE BEING TESTED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 5 May 81 p 14

[Article by Zhou Hongshun [0719 7703 7311], head of the Beijing-Wuhan Microwave Engineering Technology Section of the Ministry of Electric Power: "Our Nation's First PCM Digital Microwave Communications Line"]

> [Text] The entire project passes through Hebei, Henan, and Hubei Provinces and Beijing city, and connects the communications channels of the North China Power Network, the South Central Power Network and the Communications Dispatch Center of the Ministry of Electric Power to provide a communications channel for electricity production in those provinces and city and for water conservancy and flood prevention in the Huanghe and Changjiang River valleys.

The Beijing-Wuhan PCM digital microwave communications line, organized and constructed by the Ministry of Electric Power, is 1,263.75 kilometers long with 34 stations (3 terminal stations, 12 telephone down line stations, 2 regenerative relay stations, 17 heterodyne relay stations) and 33 zones (29 single receiving zones, 4 space diversity receiving zones). The total capacity is 480 telephone lines. This line is one of the few most advanced in the world today. The transmission line of this system--including computers, the whole design for construction including the towers, machine rooms, power source and auxiliary communications facilities of lightning arresters and grounding--were all developed domestically by ourselves. The main communications equipment and related instruments were imported from NEC of Japan. After the signing of the contract with NEC and Kokuyo Denki on 31 January 1979, our nation sent technical personnel to Japan to learn digital microwave circuit design, digital microwave communications theory and installation, testing and maintenance. During that time, they learned testing techniques at Anritsu and Sanei Testing Equipment Company, and they visited the Tokyo Electric Power Company, the Chubu Electric Power Company, the Kansai Electric Power Company, the Nippon Telephone and Telegraph Public Corporation and the Japanese National Railways to gain experience in managing communications facilities and operation. At present, under the Ministry of Electric Power and its Communications Bureau, workers and Japanese experts have basically completed installation of the equipment and testing single units together, and now they are carrying out on-line testing of the whole line. It is expected that by the second half of 1981, the whole line can begin test operation.

The structure of this system is based on related CCIR and CCITT international standards; consideration was given to the characteristics of communications networks specifically for power systems, and so the 2 GHz frequency was used. The gain of the 4-meter-diameter parabolic antenna is 36 decibels. The loss per meter on the soft coaxial feed line is 0.045 decibels. The output power of the transmitter is 30 decibels. The sensitivity of the receiver is 3.5 decibels. The 4 PSK modulation and synchronous coherence modulation are used. The relay is heterodyne of 70 MHz medium frequency. The PCM base group uses CEPT (32 TS, A rhythm, 13 breaking lines) and the rate is 2.048 megabits-second. It has a sound frequency transmission interface, a high-speed digital transmission interface and a low-speed digital transmission interface, and it can be connected to direct dialing telephones, switchboard and extension phones, magnet phones, phones connected to teletypewriters, secure phones, and dispatching phones. It can also transmit stationary images, information in analog-digital form and telemechanic data, computer data, relay protection information and telegraphic data. The second and third groups use asynchronous positive code rate adjustment and grouping of signals. The rates are respectively 8.448 megabits/second and 34.368 megabits/second. The allowable error is respectively $\pm 20\times10^{-6}$. The impedance of the interface between the first, second and third groups is an imbalanced 75 ohms. The code form is HDB_3 or AMI. The whole machine is built from structured components and assembled in a building block manner. The alarm signals are complete and the automatic circling function is strong. This makes it easy to determine breakdowns and to maintain.

Consideration was given to the characteristics of electricity production, and it was decided that the information transmitted via the communications lines of the electric power system must be versatile, accurate, superior in quality, and reliable. Therefore, when designing the Beijing-Wuhan digital microwave line, current international criteria for most reliable transmission were used. This means that over a 2,500-kilometer standard analog line, during any month of serious attenuation, the time factor of the error code rate surpassing 1×10^{-6} is guaranteed to be below 0.01 percent. The number of free communications channels remaining basically approaches the standards for "large communications lines." The antenna towers for the whole line are vertical towers. The tallest is 84 meters and the shortest is 32 meters. There are a total of 32 such towers. The system can operate under unmanned conditions in the future. The microwave transmitter and receiver and modulation-demodulation equipment are thermal backup units. Optimum automatic selection of the main microwave channel and the backup wave channel is realized by the no-hit bit composite switch. The whole machine is made of solid state components, and the amplifying components are integrated. Via the supervision and control equipment (NAR7501/7502), the system can perform three-level (station, central station of the province, headquarters in Beijing) supervision along the whole line. The central station of the province can carry out remote control of all subsidiary stations--for example, starting and shutting down the oil-fired generators. In addition, the headquarters in Beijing also has central monitoring facilities (NSV-85A), consisting mainly of a microprocessor (μPD8080), main memory (64K bytes), flexible disc (250K bytes) and typewriter, paper tape punch, paper tape readout, screen display, and business phone. This facility has the following programs: monitoring program, FEP processing program, CPU processing program, BEP processing program, support program, decision program, and applications program. Thus, the system can automatically gather and store information on the status of each station along the whole line at any time; it can access, record, and display their status at any time and supervise and control operations along the whole line in a timely manner.

The Beijing-Wuhan microwave system runs through three provinces and one city (Hebei, Henan, Hubei and Beijing city). It connects the communications channels of the North China Power Network and the South Central Power Network with the Communications Dispatch Center of the Ministry of Electric Power. It provides a communications channel for the production of electric power in those provinces and city and for water conservancy and flood prevention in the Huanghe and the Changjiang River valleys. At the same time, by extending this system and its branch lines in the future, the communications channels of the electric power networks of Eastern China, the Northwest and the Southwest can be connected, forming a telecommunications loop and network. This is very important for strengthening the safe and economic operation of the electric power system, improving the level of automation of the electric power network, and gradually improving the backward situation in technical management of the electric power industry. Also, completion of this microwave trunk line will benefit the levels of education, scientific research, manufacturing, engineering, operation and management in digital microwave communications technology in our nation.

Many years of positive and negative experience have shown us that an electric power system closely related to the life of the people of the nation is similar to the nation's railroad system. We must insist on building an independent and modern dedicated communications network. Generally speaking, the commercial communications network cannot match the structural complexity of the electric power system. The quality of information transmission of commercial telecommunications networks cannot adapt to the safety requirements and economic requirements of electric power production. The management and technology of commercial telecommunications networks and dedicated communications networks are also very different. All this has been proven by objective reality, as well as by the experience of many nations with developed electric power industries and technology.

The Beijing-Wuhan digital microwave communications system is a necessary product of the development of our nation's electric power production. It will play an increasingly important function in electric power production.

9296
CSO: 4008/123

APPLIED SCIENCES

DJS 200/XT1 COMPUTER OPERATING SYSTEM DESCRIBED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 15,5 Aug 81 p 6

[Article by Fei Xianglin [6316 5046 2651] and Tan Yaoming [6223 5069 6900] of Nanjing University: "The DJS 200/XT1 Operating System"]

[Text] Software and Service

The DJS 200/XT1 (abbreviated XT1) operating system is a general-purpose operating system developed for the domestically manufactured 220 model and 210 model computers of the DJS 200 series of computers. It has two versions, the XT1G (using the magnetic drum as the backup memory) and the XT1P (using the magnetic disc as the backup memory).

The design of the XT1G was completed in 1978, and debugging was completed in 1979. It passed inspection and evaluation in December of the same year. The evaluation pointed out: "It is a general-purpose device. It is simple, versatile and convenient to use. It possesses upward compatibility and it has reached a new level in the nation." The article introducing the system was read at the "computer science conference" held in February 1980 in Kansas City in the United States. The paper received praise. Computer scientists in the United States and Hungary wrote to ask for information concerning the paper on the XT1. In July 1980, an article on that system was published in the OPERATING SYSTEMS REVIEW, the organ of the American Computer Society.

I. Function

The XT1 performs the following main functions:

1. The operating system organizes, controls and manages writing operations in various languages. The system operates in two modes, one under automatic control and one under direct control. During the course of execution, the user can use functional commands or operating commands to change the control mode of operation any time.

2. Pre-input and slow output (spooling). The operator can input operations in batches into the computer system. The system processes the operations in batches. It allows parallel operations by four to six users. The system provides corresponding virtual equipment to realize batch processing. This shortens the operating time, increases the amount of intake and output, and improves the system's efficiency.

3. File management. The system can manipulate files on magnetic tape, on magnetic drums, on magnetic discs and files in various items of peripheral equipment. The user can conveniently use the general commands provided by the system to realize storage, search and revision of information on various pieces of equipment.

4. Management of internal memory. The system uniformly manages and controls information stored in the internal memory. During the execution of operations, the system can dynamically request and return information stored in the internal memory. This makes it convenient for the user and also improves the rate of utilization of the internal memory.

5. Management of terminals. The system allows multitasking in many ways, such as in the conversational mode, remote input and real-time data collection.

6. Interrupt processing. The system has a relatively strong interrupt processing capability. It processes interrupts at three levels during the execution of operations, i.e., it processes them by turning to the user program, it processes them according to the requirements stipulated in the operations manual, and it processes them according to the system's standard procedures.

II. Characteristics

During the development of the XT1, attention was given to gaining new ideas in the designing of operating systems abroad and the experience in our nation, and at the same time, consideration was given to its compatibility with other operating systems of DJS 200 series machines and various languages. Efforts were also made to satisfy the different needs of many types of users as much as possible. The whole system possesses the following characteristics:

1. Level structure. Level structure is a relatively advanced structure for operating systems. The functions of the XT1 are realized by the internal core and the procedures located on each level. Communications methods are used between procedures to realize internal communication (see ELECTRONICS JOURNAL, No 2, 1980, "The XT1 Operating System").

2. Mixed synchronization mechanism. The XT1 uses a mixed synchronization mechanism. This mixed synchronization mechanism consists of a primitive communication language, priority dispatching and a list reading/list writing primitive language. This not only effectively realizes synchronism of the processes and assures sharing of the source data, but it also allows the system to operate at a low cost and to be built easily.

3. Multiple dispatching strategy. To improve the system's efficiency, different dispatching strategies have been used according to the characteristics of various data sources. The data which can be distributed to the peripheral equipment for processing are distributed under a strategy combining stationary distribution and dynamic distribution to improve the rate of utilization of the equipment. The order of accession of the shared data source on the magnetic drum is optimized using the "shortest distance" method, and the waiting time for accessing the read and written information is reduced. The magnetic discs use the "escalator method" to reduce the expenditure in moving the arm. The data source in the internal memory is stored using a dynamic relocation demand assignment system. This improves the rate of utilization of space in the internal memory to the largest extent. When scheduling in and scheduling out, the strategy of first-in first-out, which occupies the least amount of internal memory, is used for processing user operations in order to conserve the use of the backup memory. When an operation is being processed, the system does not select new operations for storage in the internal memory so as to avoid unlimited delay in one operation.

4. Less internal memory use. The XT1G has about 23K bytes of memory. Because the overlay technique is used, the permanently stored data occupy only 6K of internal memory--less than 10 percent of the total internal memory (usually, total internal memory is 64K).

5. Greater versatility. By simply adding or reducing the number of modules it can be adapted to the various hardware configurations and needs of users.

6. Better accuracy. Many measures have been used to avoid deadlocks. The system has been logically proven that it will not produce deadlocks. (See the JORNAL OF NANJING UNIVERSITY, National Sciences Edition, No 2, 1978, "A Method to Prevent Deadlocks")

7. Convenient to use. The user can operate and run computational problems after brief and simple training.

III. On-Line Debugging of the XT1G

The first version of the XT1 operating system passed the on-line debugging evaluation with standard FORTRAN in December of 1979 (designed by the state-run Beijing Wire Communications Equipment Plant). It passed on-line debugging evaluation with COBOL in December of 1980 (designed by the Nanjing University, the Nanjing Wire Communications Equipment Plant, et al). Recently, it successfully passed on-line debugging with expanded FORTRAN (designed by Beijing University, Shanghai Computer Plant), and was evaluated in May 1981. It is currently undergoing on-line debugging with compiler languages and it will continue to undergo on-line debugging with ALGOL, so that the DJS 200 series will gradually form a computer system with complete software support and the operating system will be convenient to use.

IV. Brief Report on the XT1P

The XT1P operating system is the second version of the XT1 operating system. It inherited the system structure of the XT1G, but its functions have been expanded. The expanded functions of the XT1P over those of the XT1G are mainly: magnetic disc management, magnetic disc file management, management of terminals slow output and automatic scheduling of the compilation system for different languages.

The XT1P also has the capability for batch processing and time-shared processing. It can control six batch processing operations or it can simultaneously operate with terminal operations. It can support compilation systems for eight languages, and it can provide multitasking terminal operations in the conversational mode, remote operation input mode and real-time data gathering.

The XT1P provides a common access magnetic disc file and a dedicated magnetic disc file for the user. The common access file serves as a temporary file for many users to store data simultaneously. The dedicated magnetic file serves as a storage file for one user alone. The user can establish a dedicated file as a permanent record.

The XT1P has many methods of file organization for the convenience of the user. It has a sequential file, a direct access file, an index file, an indirect file, an indexed sequential file, and a drum sorted file.

The XT1P and XT1G are compatible. Information processed under the control of the XT1G can be processed under the XT1P without any modifications.

The development of the XT1P is in progress. Debugging is scheduled for July 1981, and its application is expected in 1982.

9296
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APPLIED SCIENCES

HAJIF-II PROGRAM SYSTEM DESCRIBED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 3, Mar 82 pp 2-4, 19

[Article by Guan Te [4619 1795]: "An Introduction to HAJIF-II--A Program System for the Dynamic Analysis of Aircraft Structures"]

[Text] HAJIF-II is a program system developed under the direction of the Chinese Aeronautical Establishment (CAE) for performing dynamic analysis of aircraft structures. It can carry calculations of fundamental dynamic characteristics of structures (e.g., fundamental frequencies and modes), as well as flutter calculations and gust response calculations for an airplane with active control systems.

HAJIF-II was developed on the Ximengzu-7760 computer. The development started in November 1979, and was completed in July, 1981; in November 1981 it was certified by the CAE. Participants in the development were members of the Third Ministry of Machine Building and the five Institutes of the CAE.

Development of HAJIF-II not only followed the general guidelines for designing large program systems such as reliability, generality, flexibility, automated operation, high efficiency, ease of modification and expansion, and diagnostic capability, but also incorporated new ideas to make the program as practical as possible. During the system design, a number of new methods were developed, and new results published in foreign journals during the 1970's were used. All of these new techniques were tested and verified before implementation. For problems which require research and exploration, considerations were given to as many different approaches as possible. Techniques which had been proven to be effective in actual engineering use were collected; and only those mathematical and mechanical formulas which were specifically designed for airplane applications were incorporated.

In performing calculations of fundamental dynamic characteristics, the structure can be considered either as a single body or as a synthesis of several substructures; it can be simulated using the dispersed finite-element model or can be approximated by simple beam models. For flutter and gust response calculations, the method of modal superposition is used.

The structure can be divided into 99 substructures, each with as many as 7000 degrees of freedom. As many as 300 panels can be used in the calculation of non-steady aerodynamic forces, and 50 modes can be accomodated in flutter and gust response analysis.

The program contains 31 prescribed computational flows. There are 7 in the fundamental dynamic characteristics calculations (representing the integral structure method, the fixed-interface single-level synthesis method, the free-interface single-level synthesis method, the fixed-interface multi-level synthesis method, the free-interface multi-level synthesis method, the fixed-interface successive synthesis method, and the free-interface successive synthesis method), 2 in the flutter calculations (representing the V-g method and the p-k method), 1 in gust response calculations, and 21 for calculating the combined effects of fundamental dynamic characteristics, flutter, and gust response. There are approximately 26000 FORTRAN instructions in the system.

A general description of the system will be presented below.

1. Data Generation

One of the problems in using the finite-element method to analyze large structures is the large amount of labor required in data preparation. From the user point of view, it would be desirable to have automatic data generation capability. Since modern airplanes generally have wing spans with small aspect ratios and irregular arrangement of structural components, it may not be feasible to generate structure data using overly simplified methods; also, the results may not meet the accuracy requirements in verification calculations. Therefore, in HAJIF-II, provisions are made to have the flexibility of either manual input of numerical data or automatic generation of data via topological description. In addition, since the user with a small or medium size problem generally does not have a large amount of data, he may not want to take the trouble of learning the language for topological description of structures; therefore, two different forms of input have been designed: simple numerical data input and mixed input.

2. Element Storage

The use of finite-element method to simulate airplane structures requires proper storage of the elements. There are 12 different types of elements in the element storage of HAJIF-II. Each element contains a stiffness matrix and a mass matrix. The primary design considerations of the element storage are based on the requirements of simulating the wing surface, the fuselage, the suspended objects, and their inter-connections. In addition to the commonly used rods, plates, and spars, consideration is also given to the possible use of simple beam structure to simulate the wing surface; therefore, a special beam element is also included.

3. Stiffness and Mass Matrices

The calculation of fundamental dynamic characteristics is based on the following equation:

$$k\ u = \lambda m\ u \tag{1}$$

where k,m are respectively the stiffness matrix and the mass matrix; λ is the square of the frequency, and u is the fundamental mode. In general, solution of this equation is obtained by iteration, which requires repeated use of the matrices k and m. Therefore, the effective management of k and m is a key element in improving the computational efficiency . In HAJIF-II several measures are taken to achieve this goal.

In selecting the degrees-of-freedom of nodes, a variable degree-of-freedom technique is used. In other words, the number of degrees-of-freedom is not fixed, but rather is determined by the number of elements connected to the node. As a result, superfluous degrees-of-freedom are eliminated.

For multi-level structures, nodal renumbering and bandwidth optimization techniques are used to reduce the bandwidths of the k and m matrices.

The k and m matrices contain a large number of zero elements. In HAJIF-II modified hyper matrix technique is used so only the non-zero nodal elements are stored. Specifically, the k and m matrices are first divided into zeroth order submatrices; the zero and non-zero submatrices are denoted by zero plus non-zero elements. Clearly. the zero submatrices still contaon zero elements. Hence, the submatrices are then subject to "microscopic processing" using the concept of effective rows to further eliminate zero elements.

In HAJIF-II the nodal degrees-of-freedom can be contrained using either single-point or multi-point constraint techniques. The effect of single-point constraint is to simulate various boundary conditions and symmetric or anti-symmetric conditions by fixing the displacement of a particular degree-of-freedom. Multi-point constraint on the other hand is to control the relations among various degrees-of-freedom by expressing part of the degrees-of-freedom as linear functions of others.

4. Calculation of Real Eigenvalues

The solution of Equation (1) is accomplished using a simultaneous iteration procedure (or subspace iteration procedure). During the design of HAJIF-II, a new algorithm was developed by combining the merits of various iteration methods currently being used. The new algorithm has the following features: (1) the mass matrix does not decompose, and remains unchanged; (2) vectors which have already converged are eliminated to reduce the number of vectors to be iterated; and (3) the computational procedure is improved. In comparison with existing methods, the new algorithm has the same rate of convergence, but each iteration involves less computations, thus resulting in higher computational efficiency.

5. Modal Synthesis

In the calculation of fundamental dynamic characteristics, the structure can be treated as a single body. But for large structures, it is desirable to divide the structure into a number of substructures and determine the fundamental dynamic characteristics of each substructure; the fundamental characteristics of the overall structure is then obtained by superposition. This results in higher computational efficiency. In some cases, repeated calculations are performed where only a subset of structural parameters are varied. For example, in the analysis of wing structure in conjunction with suspended objects or control surfaces,only the parameters of the suspended objects or control surfaces are varied. It is clearly uneconomical to repeat the calculations for the entire structure each time; it would be more efficient to use the method of modal synthesis.

The method of modal synthesis was developed in the 1970's; its application in this country is still in the infant stage. In HAJIF-II, not only the main branches of modal synthesis, i.e., the method of fixed-interface and the method of free-interface, were adopted, but two new methods of synthesis based on the concept of multi-level substructures were developed-- the method of multi-level synthesis and the method of successive synthesis, as shown in Fig. 1. In the method of successive synthesis, only one of the two substructures is analyzed to determine its fundamental characteristics; the other is directly synthesized using the equations of physics.

6. Non-Steady Aerodynamic Forces

Although modern airplanes can fly at supersonic speeds, most serious flutter conditions occur near sonic speeds at low altitudes. Currently, there is no reliable engineering method that can be applied to transonic lifting surfaces. Results based on subsonic wing theory can reflect basic flutter characteristics with reasonable accuracy. Therefore, a subsonic doublet lattice method is implemented in HAJIF-II to treat multiple wing structures in three-dimensional space.

The non-steady aerodynamic theories currently in use are primarily based on the assumption of sinusoidal vibration. Methods which can handle general non-steady lifting surfaces with non-sinusoidal vibrations are still of limited practical use. In order to treat non-sinusoidal vibration problems such as subcritical flutter response, an approximate method developed in the 1970's is used in HAJIF-II. This method uses an interpolating function to determine the non-steady aerodynamic forces in the Laplace plane based on sinusoidal solutions.

7. Flutter Calculation

In HAJIF-II, flutter characteristics are computed using the V-g method and the p-k method. With the p-k method, the effect of active control systems can be taken into consideration. The flutter problem is essentially a complex eigenvalue problem. In HAJIF-II three methods of solution are offerred: the complex QR method, the complex LR method, and the inverse power method with origin shift.

8. Calculation of Gust Response

The calculation of gust response in HAJIF-II is based on a continuous atmospheric turbulence model. By performing the analysis in the frequency domain, and taking into account the effect of active control systems, it can estimate the low-frequency vibration of the airplane, and also provide data for designing active control systems. The system can calculate the aeroelastic frequency response function of each node of the airplane structure, i.e., the amplitude and phase response under the action of a sinusoidal gust with unit strength. It can also compute the power spectrum and associated statistics of the response function corresponding to a given atmospheric turbulence model. Atmospheric turbulence can be simulated using a system-provided Karman power spectrum model or from user input.

9. Program Organization

The programs of the HAJIF-II system are organized into two levels. The first level is the executive program, which consists of almost exclusively transfer instructions. The second level consists of processing routines which are high-level subprograms controlled by the executive program and capable of independent calculations of prescribed mathematical and mechanical functions. No transfer of command is allowed between two processing routines. Each processing routine can only have input/output relations with a data base. This feature greatly improves the flexibility and efficiency in program debugging and testing, program termination and starting, as well as in flow organization and capability expansion.

In the executive program, a variable-length common data block is established for use by each processing routine. Except for a very small data block that can be generated by the individual processing routines, all other data must be allocated from this common data block. There are three different methods of allocation: static allocation, dynamic allocation, and mixed allocation. In the case of dynamic allocation, the concept of boundary-less data block is adopted.

For those sections which have relatively large internal storage requirements, the system can automatically judge the amount of required internal storage, and decide if external storage would be used. In this manner, the solution of both large and small problems can be carried out without sacrificing computational efficiency.

10. Data Organization and File Management

The entire data base of the HAJIF-II is called a "directory". It is composed of several files (whose number can be expanded); each file is divided into 100 records; and each record is divided into 100 blocks. The files are organized according to the individual processing routines. The records are designed to facilitate the analysis of the substructures; for example, the data of each substructure can be compiled into one record. A block is the basic unit of data management; it contains all the data associated with each instruction. Each block is denoted by its block address.

The file management system of HAJIF-II can perform the functions of file distribution and control of associated variables. For data exchange, the system can accomplish the READ and RITE functions automatically by simply transmitting the input/output tables and addresses to the file management system.

11. User Interface

To use the HAJIF-II system, the user must supply three kinds of information: (1) mission document, (2) numerical data, and (3) topological description. In return, the system provides the following information to the user: (1) calculated results, (2) error messages, (3) name of the processing routine being executed, and (4) execution time.

Two kinds of user-oriented global instructions are available in HAJIF-II. One is used to initiate the 31 prescribed computation flows; the other is to allow the user to organize his own computation flow by transferring to the various processing routines. Both flow options can be executed either via batch processing or via interactive dialogue. The pre-requisite for using these two flow options is that the required data must be in a readily accessible data file.

HAJIF-II also provides the capability for error diagnosis. Since most errors are caused by errors in the initial data, the diagnostic procedure emphasizes the inspection of initial data, and the output of as many as reference messages as possible. In addition, the user can also request certain sophisticated and more time-consuming diagnostic procedures.

12. Sample Calculations

In order to test the performance of the system, calculations were carried out for a total of 56 test cases during the development of HAJIF-II. Of these cases four were synthesis calculations with 21 different configurations. They include: calculation of the fundamental characteristics of a 60° triangular cantilevered wing with and without suspended objects; calculation of the free-state fundamental dynamic characteristics of the combined structure of the above triangular wing, the fuselage, and the horizontal tail; flutter calculation of the above triangular wing without suspended objects; calculation of the fundamental dynamic characteristics of a 40° triangular wing; complete structural calculation of a beam-model consisting of a straight wing, fuselage, tail, and engines, and six modal synthesis calculations; and calculation of the gust response of a B-47 airplane. Satisfactory results were obtained in all the above test cases.

There are plans for further development of the HAJIF-II system. The near-term objectives are: (1) to incorporate additional techniques for non-steady aerodynamic calculations; and (2) to provide the capability for analyzing other types of dynamic responses.

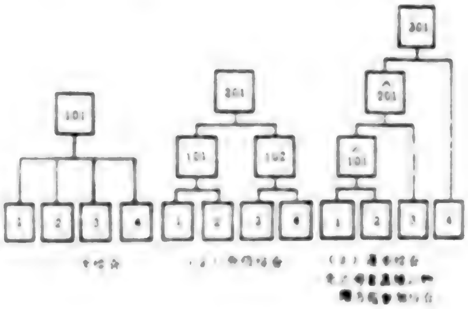


Fig. 1

(1) single-level synthesis
(2) multi-level synthesis
(3) successive synthesis; the blocks without the symbol ^ represent direct participation in the synthesis using equations of physics

3012
CSO: 4008/136

CABLE TELEVISION PROSPECTS, APPLICATIONS DESCRIBED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE AND TECHNOLOGY] in Chinese No 2, 1982 pp 2-5

[Article by Yang Jinxiang, [2799 6855 7449], Beijing Municipal Research Institute of Television Technology: "Development and Applications of Municipal Cable Television"]

[Text] With the development of the television broadcasting industry and the rapid increase in the number of users of television sets, the question of effective television reception has become a pressing one. This article provides an introduction to the development and applications of municipal cable television.

Development and Basic Organization of Community Antenna Television Systems

The efficiency of the carrier waves used for wireless transmission of television signals is very high. The VHF band, between 48 and 223 MHz, uses ultrashort waves. These have characteristics similar to light waves; essentially propagating in straight lines and being reflected when they encounter an object. If in their transmission path television waves encounter a mountain or a tall building, they may be blocked, resulting in a "blackout area" where there is no television reception.

Television carrier waves are horizontally polarized. They are spatial waves radiated directly from the transmitting antenna to the receiving antenna. A spatial wave consists of a directly radiated wave and a reflected wave. Because the reflected wave and directly radiated wave take different paths, they differ in phase when they arrive at the receiving antenna. Because cities generally contain large numbers of buildings, not only waves reflected from the ground, but also many waves reflected from buildings arrive at the point of reception, with the result that the field intensity distribution in the vicinity of city buildings is very complex; in some locations the field is strong (about 100 dB), while in others it is weak (below 60 dB). In addition, serious ghost image problems are produced by multipath reflected waves.

City expansion is producing increasing numbers of tall buildings, and inside reinforced concrete buildings the screening effect of the steel reinforcing rods results in very weak field intensity, in some cases only 40-50 dB, making it impossible to receive television programs, or if they can be received, strong multipath reflected waves produce a serious ghost problem and noise. In addition, interference from industry and various types of electrical equipment also has a serious effect on VHF television reception.

For these reasons, more and more television users have had to erect outdoor television antennas in order to get adequate reception. But if every set has its own antenna, this not only affects the appearance of cities and wastes large quantities of metal and cable, but is also unsafe. In addition, several television sets whose antennas are very close together may interfere with each other as a result of the radiation they produce themselves. The best solution in areas with high concentrations of television sets (such as apartment buildings or closely spaced groups of apartment buildings and the one-story buildings in their "blackout areas") is to set up one or a group of antennas to receive the signals, then use a signal divider network to feed the signal to the individual sets. Many television sets will require only one antenna, and it will be possible to use a cheap, good-performance antenna and to install it in a relatively favorable location. The signal distribution network can be economically wired in terms of the actual locations of television sets in the building, to assure that there is adequate separation between individual sets (generally greater than 25 dB). This method actually groups a number of individual receivers into a collective receiving system; it is called community antenna television (CATV).

Since the first CATV system was erected in the United States in 1949, such systems have made great progress in terms of technology, facilities and range of uses. Table 1 shows the development of CATV in the United States between the early 1950's and the early 1970's. The situation is similar in such countries as England, Japan, West Germany and Canada.

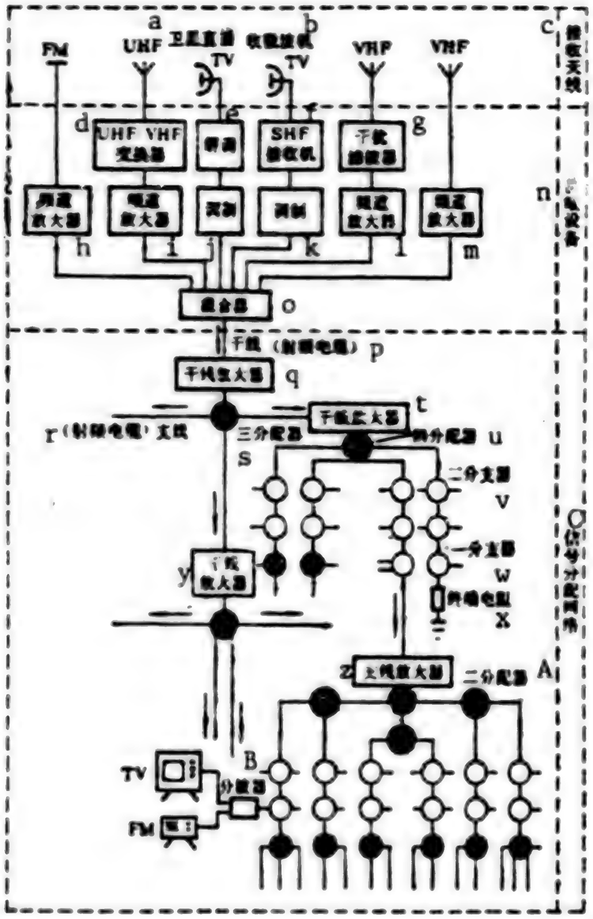
Table 1.

年 份[a]	CATV设备数[b]	电视机用户数(个)[c]
1952	70	14000
1954	300	65000
1956	450	300000
1958	525	450000
1960	640	650000
1962	800	850000
1964	1200	1085000
1966	1570	1575000
1968	2000	2800000
1970	2350	4500000
1972	2750	6000000

KEY: a. Year
b. Number of CATV installations
c. Number of users

The CATV system consists of a receiving antenna, a head end unit and a signal distribution network, as shown in Fig. 1.

Figure 1.



KEY: a. Direct satellite reception
b. Microwave receiver
c. Receiving antennas
d. UHF-VHF converter
e. Demodulator
f. SHF receiver
g. Interference filter
h. Channel amplifier
i. Channel amplifier
j. Modulator
k. Modulator
l. Channel amplifier
m. Channel amplifier

n. Head end
o. Mixer
p. Trunk (cable)
q. Trunk amplifier
r. Feeder
s. Three-way distributor
t. Trunk amplifier
u. Four-way distributor
v. Two-line tap
w. Single-line tap
x. Terminal resistor
y. Trunk amplifier
z. Feeder amplifier
A. Two-way distributor
B. TV-FM signal separator
C. Signal distribution network

1. The basic task of the receiving antenna and head end unit is to receive the space wave and convert it into an electrical signal, then amplify it to a level which gives the required signal to noise ratio and feed it to the trunk cable.

The selection of an antenna and head end unit should be based on the field intensity and the direction from which the waves are received, the geographic location, environmental conditions, the size of the system, and user requirements.

In a location where the field intensity is high (e.g., greater than 100 db), there is no reflection and several transmitting antennas are located in approximately the same direction relative to the receiving location, when the CATV system is relatively small (e.g. in an ordinary residence), a broad-band antenna for channels 1-12 can be placed in a suitable location on the roof of the building and the signal can be fed directly through the distribution network to the individual sets without amplification. This method not only is economical, but also makes it unnecessary for the users to add new antennas in the future when stations are broadcasting on more frequencies; see Figure 2.

Figure 2

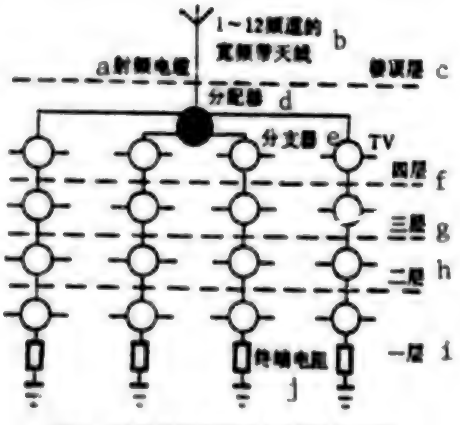


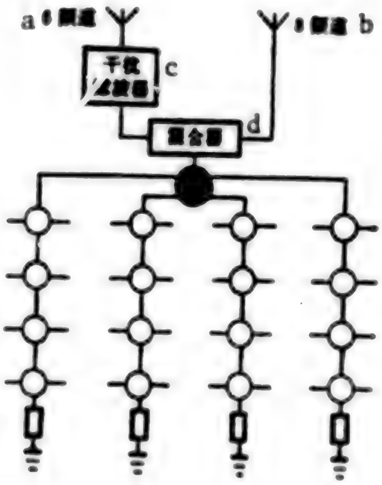
图2 普通居民住房的 CATV 系统图

Fig. 2 CATV system for ordinary apartment building

KEY: a. Cable
b. Broad-band antenna for channels 1-12
c. Roof
d. Distributor
e. Distributor
f. Fourth floor
g. Third floor
h. Second floor
i. First floor
j. Terminal resistor

In locations where the field intensity is fairly strong (e.g., greater than 95 db) but reflected waves produce ghosts and interference, highly directional antennas for specific channels which have a high front-to-back ratio must be used. This is because a single-channel antenna has a greater gain than a broadband antenna as well as sharp directionality and a good standing wave ratio, making it possible to overcome ghost production and decrease noise. For special channels it is possible to install a channel filter to decrease interference. If single-channel antennas are used, the best reception point can be selected for each channel. Under these circumstances several antennas are required in order to receive several different programs; their signals are combined in a mixer, then fed to the trunk cable as shown in Fig. 3.

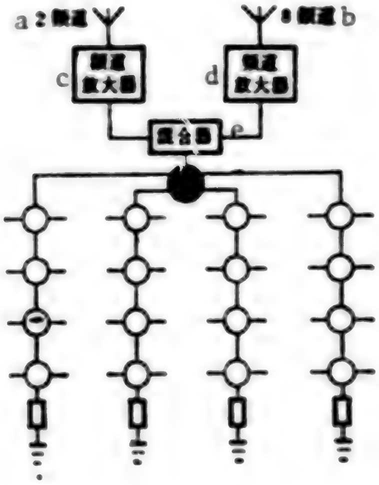
Figure 3



KEY: a. Channel 6
b. Channel 8
c. Interference filter
d. Mixer

In areas where the field intensity is relatively weak (generally less than 60-70 dB) and there is a relatively large amount of interference, in order to assure a sufficient signal to noise ratio the signal from the antenna must be amplified to a suitable level before feeding it the cable. Under most conditions there will be considerable differences between the signal strengths of different channels received in the same location, and in order to enable the television sets to receive largely equivalent signals from all of these channels it is best to provide an individual channel amplifier for each signal before the mixer, as shown in Fig 4. By adjusting the gains of these amplifiers, the signals can be fed to the mixer at equal strength. Because the channel amplifier acts both as an amplifier and as a filter, image quality is relatively good.

Figure 4.



KEY:
- a. Channel 2
- b. Channel 8
- c. Channel amplifier
- d. Channel amplifier
- e. Mixer

Because cable loss is proportional to the square root of frequency, when receiving ultrahigh frequency (UHF) signals a frequency converter is generally installed in the head end unit to convert the UHF signal to a VHF signal, which is then distributed to the users. If the head end of a CATV system also is provided with some type of microwave converter equipment and superhigh-frequency converter equipment, all of the television users in the system can receive microwave cable and satellite television transmissions directly. In addition, large CATV systems head ends also have a pilot signal generator which provides the control signals required for automatic gain control and automatic tilt control in the trunk amplifiers of the signal distribution network.

2. The task of the signal distribution network is to distribute a television signal of the requisite quality to the individual sets. It

includes trunk cable amplifiers, distributors, feeder amplifiers, taps, matching elements, and in some cases TV-FM signal separators.

After the signal has been fed to the trunk cable, it is amplified by the trunk amplifier to make up for trunk cable losses and restore signal quality to the previous level, after which the signal is distributed at equal power to several feeder cables by a distributor; a tap draws off some of the signal power from the feeder cable and sends it to the matching elements via a branch feeder cable, from which it is transmitted to the individual television sets. If the CATV system also includes FM reception, the drop cable transmits the signal to a signal divider, which separates the television and FM signals, after which they are sent to separate matching elements and from there to the individual television and radio sets. If the cable attenuation after the tap is large, a tap amplifier can be added; see Fig. 1.

The Development of Closed Circuit Television

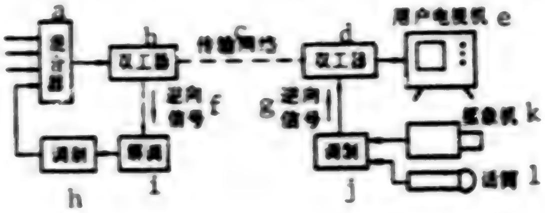
The CATV system was originally developed to solve television reception problems, but after a perfected signal distribution network was used to provide reception to several television sets, it could carry not only television signals broadcast through the air, but also locally produced television signals; provided there was a program production capability it could constitute a complete closed circuit television system (CCTV). A CCTV system generally consists of a head end unit and video recorders, video disk players, TV film units and the like, and may even be provided with a complete small set of small-scale studio equipment. This greatly enriches the content of television programs. According to statistics, in 1973 more than 50 percent of all CCTV systems in the United States could do their own broadcasting. Independent broadcasting on these systems was generally of two types: the first included videotaped programs, movies, and educational and local news programs, all of which were produced within the system; the other type used automatic broadcast equipment which automatically broadcast weather reports, standard time, music, commercial advertisements and the like at fixed intervals. Once CCTV systems of this type are established, their applications value obviously greatly exceeds that of broadcast television, and non-broadcast television is developing rapidly on a large scale within the CCTV industry.

Development of Two-Way Closed Circuit Television Systems

In order to expand the capabilities of CCTV systems, such countries as the United States, England, Japan and Canada are actively developing two-way closed circuit systems in which transmission can be conducted in both directions simultaneously. As early as 1970, two-way CCTV systems which could be used for fire warning, burglar alarms and information and could transmit simple reply signals were displayed at a conference of the United States National Cable Television Society.

The basic operating principle of CCTV is shown in Fig. 5.

Figure 5. Block diagram of two-way cable television system



KEY:
- a. Mixer
- b. Duplexer
- c. Transmission network
- d. Duplexer
- e. User television set
- f. Upstream signal
- g. Upstream signal
- h. Modulator
- i. Demodulator
- j. Modulator
- k. Camera
- l. Microphone

A band below the first television channel (30-45 MHz) and a band between the FM band and VHF television channel No 6 (120-160 MHz) are generally reserved as the upstream (from the user to the head end unit). TV signal transmission bands. The video signal put out by the user's camera and the audio signal put out by the microphone are used to modulate the 30-40 MHz or 120-160 MHz carrier, and the high frequency all-television signal form is fed into the transmission trunk to the head end unit. A demodulator in the head end unit reconstitutes the audio and video signals from the user, then uses them to modulate the required frequency channel and transmits it to another user. In this way users can exchange programs they have produced themselves.

Two-way closed circuit television is used extensively in television in ruction. If a broadcast control center is added to the head end shown in Fig. 5, the lecture given by a teacher in the broadcast control center is recorded by camera and microphone, then sent via the modulator to a mixer for transmission to classrooms; similarly, the classroom camera and microphone are used to transmit the class situation back to the control center, using a duplexer. Medical school surgical demonstrations can be transmitted to the broadcast control center as control signals, then rebroadcast to other classroosm. In addition, special signal generators located in the classroom can be used to send control signals to the control center for automatic operation of video recorders. The technological quality of two-way closed circuit television can be improved; not only will it be possible for individual users to exchange television programs, but the content of the programs has already gone beyond that of broadcast television. Two-way closed circuit television has gradually developed into a combination of television, broadcast, telephone, data and other information exchange.

Optical Cable Systems

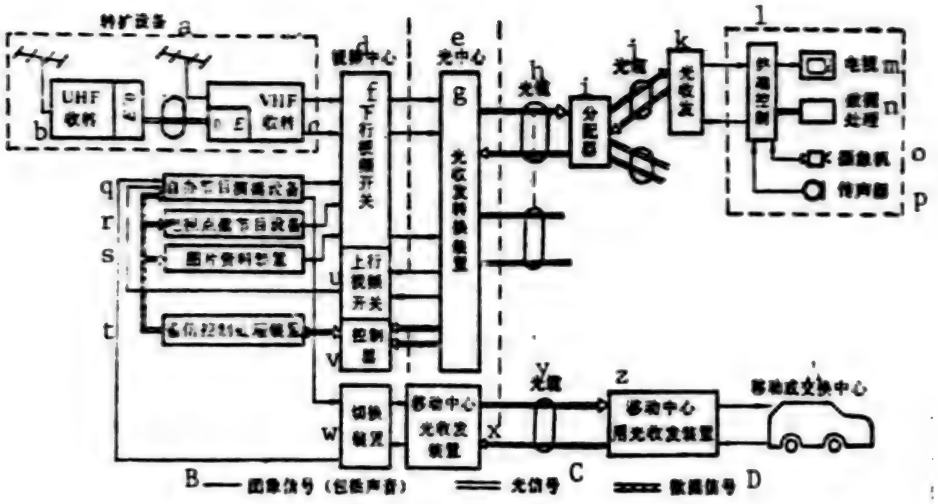
The scale of closed circuit television is steadily increasing, the lines are gradually becoming longer, more and more signals are being transmitted, and the weak points of electrical cable as a transmission medium are becoming increasingly apparent. The characteristics of optical cables are increasingly attracting favorable attention. Currently optical cable transmission losses are much smaller than those for electrical cables, their costs have decreased to the point where they are competitive with electrical cables, and the components and parts of optical transmission lines are steadily improving, so that optical cable systems are beginning to enter the application stage.

Since 1974, such countries as the United States, England and Japan have applied optical fiber transmission theory to CATV systems and have organized optical cable transmission networks, thus overcoming the problems resulting from the large size of cable used in two-way closed circuit television and CATV networks, so that people can select television broadcast programs from a range of locations at will.

CATV systems can be used extensively in television education, clinical consultations, technical experience exchange, industrial management, facsimile transmission, commercial information and the like, creating the "wired city," and realizing the dreams of mankind.

For example, in 1978 a "optical fiber wired city" was begun in Higashi-ikoma near Osaka, Japan; it replaces coaxial cable with optical cable and features two-way service systems. The system is shown in Fig. 6. The program exchange center has news, cultural programs (including color television, stereo sound broadcasting, and image date); the communications control and processing equipment includes TV, telephone, telemetry, emergency reporting, computer controlled instruction and the like.

Figure 6.



KEY:

- a. Conversion equipment
- b. UHF receiver-converter
- c. VHF receiver-converter
- d. Video signal center
- e. Optical center
- f. Downstream video switching
- g. Optical transducer-converter
- h. Optical cable
- i. Distributor
- j. Optical cable
- k. Optical receiver
- l. Terminal control
- m. Television
- n. Data processing
- o. Camera
- p. Sound pickup
- q. Studio equipment
- r. Remote
- s. Graphic data equipment
- t. Signal control and processing equipment
- u. Upstream video switching
- v. Controller
- w. Switching unit
- x. Mobile center optical transducer equipment
- y. Optical cable
- z. Mobile center's optical transducer
- A. Mobile or exchange center
- B. Facsimile signal (including audio)
- C. Optical signal
- D. Data signal

In addition, independent cables installed in major assembly places, theaters, schools and hospitals, and when necessary a mobile exchange center (rebroadcast truck), can be used for temporary transmission of special programs.

Conclusion

Our country's CATV systems have already entered the application stage. Many hotels, restaurants, schools and new multistory buildings in Beijing are equipped with such systems, and development is gradually proceeding from simple CATV systems to closed circuit TV systems. Relevant units are pursuing serious research and are preparing to draft CATV standards for our country. The situation is a gratifying one. Development and practical work on optical systems has also made much progress. If further large-scale planning can be conducted, prospects for development are extremely great. The development and applications of cable television will be sure to make a contribution to our country's four modernizations.

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APPLIED SCIENCES

TRANSONIC AXIAL COMPRESSOR TEST RIG DESIGNED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 11, 1981 pp 2-4

[Article by Fang Jianshan [2455 6015 1472]: "Experimental Transonic Axial Compressor"]

[Text] The axial compressor is a key component of the turbojet engine in modern aviation. To improve the performance of the compressor, we must study the very complex ternary flow involving viscosity, shock wave and secondary flow. It is difficult to deal with many of the phenomena and problems in such a complex flow process completely by theoretical analysis. Even if we used the presently developing theory of ternary flow to design the compressor, it would have to be done on the assumption of a previously given loss distribution. But a rational assumption can only be made by carefully measuring and analyzing in detail the internal flow field of the compressor and only after fully understanding the patterns of such flow.

For this purpose, the Thermophysics Institute of the Chinese Academy of Sciences designed and built a transonic single and double stage axial compressor testing rig in order to conduct basic experimental research (see Figure 1). The equipment consists of an intake and exhaust system, a power generator and a transmission system, a lubricating and cooling system, a measurement and data gathering and processing system and an operating and control system.

When the experimental unit is in operation, air is sucked in and passes through the intake muffler tower, a double layer filter mesh, and enters the air intake chamber separated from the experimental housing. The air exhausted from the experimental compressor is collected by an exhaust collector and channelled into underground tunnels. Then it passes through the exhaust muffler tower and is released into the atmosphere. This new whole body design not only prevents the mixing of air currents flowing from the experimental housing to the flow measuring devices at their intake point, thus causing the flow measurements to be inaccurate, but it also improves the rate of utilization of the experimental housing and is beneficial to noise elimination and soundproof design of the whole facility.

The following is a brief introduction to the major components of the experimental facility and their characteristics.

Figure 1. Experimental Platform of the Transonic Axial Compressor

I. The Power Generator, the Transmission System and the Lubricating and Cooling System

The power source rebuilt from an airplane engine is simple to operate, but the problem of environmental pollution is difficult to solve. In particular, the steady speed precision generally reaches only 0.2 percent, and this is unfavorable to improving the precision of the whole experiment.

This experimental unit uses a ZD180/31.5 high-velocity direct-current electric motor as the power source. The specified capacity is 3,000 kilowatts. The highest designed speed of rotation is 750 revolutions/minute. Its operating range is wide. Its overload capability is high. It has a broad and smooth velocity governing characteristic, and automated operation and control is easy to realize. The operating characteristic curve of the electric motor and the range of the parameters of the experimental compressor being driven by motor are shown in Figure 2. The experimental compressor is driven by a controllable silicon transmission device of a precise velocity governing system of 3,000 kilowatts especially developed for this purpose to improve the precision of steady speeds. Alternating current of 10,000 volts passes through two rectifier-transformers to lower the voltage. Then the current is rectified in 12 phases through 4 three-phase fully controlled rectification bridges to become a direct current. Then it is fed to the armature winding. By changing the silicon-controlled lead-pass angle, we can change the voltage at the electric motor terminal to realize adjustments and stabilize the speed of rotation (we can also use the weak magnet operating system of the controllable silicon-controlling device for speeds over 550 revolutions/minute). The entire control process is digital, i.e., digitally given (speed of rotation), (speed of rotation) digital feedback and digital display. The signal of the given speed of rotation are mathematically calculated by subtraction in the full subtracter. The difference is converted, adjusted and fed to the trigger circuit to generate the trigger control signal which changes the silicon-controlled lead-pass angle. The circuit also eliminates the static error of the system by utilizing the error integration channel to eliminate residual deviation and thus realize error-free velocity control.

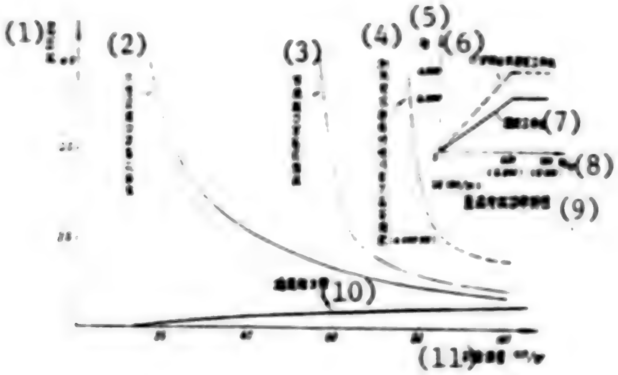

Figure 2. Power Characteristics of the Electric Motor and the Range of Parameters of the Experimental Compressor

Key:
(1) Total pressure ratio
(2) Limitation of the experimental range of barometric pressures at entry
(3) Limitation of the experimental range of throttle entry
(4) Limitation of the possible experimental range utilizing overload characteristics of the electric motor
(5) Kilowatts
(6) 15-minute allowed overload operating line
(7) Specified operating line
(8) Revolutions/minute
(9) Power characteristics of the direct-current electric motor
(10) Channel resistance limit
(11) Converted to amount of flow, kilograms/second

The feedback signal of the speed of rotation needed by the governor system must be accurate and reliable. If the signal is discontinued, the experimental device will lose control, exceed its speed limit and even break down. For this, we have designed a dual circuit rotational speed pulse generator. Electromagnetic and photoelectric rotational speed pulses serve as each other's reserve. When one circuit malfunctions during operation, the other circuit automatically begins operation.

The silicon-controlled element is cooled by the de-ionized cooling water supplied by the pure water supplier, while the electric motor is cooled by a closed-circulation fan cooling system.

The results of test runs show that the transonic compressor driven by the above power generator can rapidly and conveniently change its speed of rotation. The steady state and steady speed precision is better than 0.03 percent, reaching the internationally advanced level of similar compressor testing equipment.

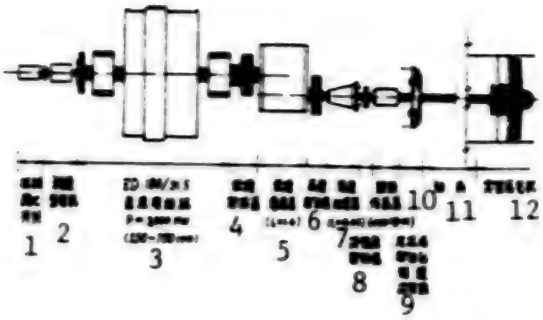

Figure 3. Illustrative Diagram of the Transmission System

Key:

(1) Mechanical centrifugal switch
(2) Velocimeter generator
(3) ZD180/31.5 direct-current electric motor
(4) Low-speed shaft joint
(5) Low-velocity speeder
(6) High-seed shaft joint
(7) High-velocity shift
(8) Flexible disk shaft joint
(9) Torque sensor
(10) Nylon cord shaft joint velocimeter gear disk
(11) Axile shaft system
(12) Experimental compressor

Figure 3 illustrates the transmission system. The output of the 3,000 kilowatt direct-current electric motor can reach a maximum rotational speed of 12,000 revolutions/minute (or 15,000 revolutions/minute) after being speeded up by a low-velocity gear speeder with a speeding ratio of i = 1.4 (or 1.74) and a planetary high-velocity gear speeder with a ratio of i = 11.45. The output axile of the high-velocity speeder drives the experimental compressor via the torque sensor which drives the transmission shaft system. The standard calibration for adjustment and installation of the transmission system is selected as a low-velocity speeder to reduce cumulative deviation from nonconcentricity. The radial and axial nonconcentricities of the electric motor and the low- and high-velocity gear speeders are adjusted to ≤ 0.02 millimeters. Consideration is also given to the thickness of the oil film on the sliding bearings during operation, so allowance for nonconcentricity was preset during stationary readjustment.

Nylon pin elastic shaft joints are used to connect the electric motor and the low-velocity speeder as well as the low-velocity and high-velocity speeders. The shaft joints do not transmit axial force and they have a definite flexibility, suitable for transmission equipment of large power and low speeds of rotation.

To insure normal operation of the torque sensor, the method of connecting it to the high-velocity speeder and the transmission shaft system must be carefully selected. This experimental device uses elastic disk shaft joints of equal thickness between the torque sensor and the high-velocity speeder. At the time of installation, we first made sure that their concentricity requirements were satisfied. We designed a nylon cord shaft joint (see Figure 3) suitable for large power and high rotational speeds between the torque sensor and the transmission shaft system. The difference between the nylon cord shaft joint and ordinary shaft joints is that when we designed and installed the shaft joint, we made sure that the driving disk and the driven disk were in the same axial plane as much as possible, thus basically eliminating axial forces. Experience of operation shows that as long as the radial nonconcentricity is $\le$0.2 millimeters, it can operate normally. Compared to other joining methods, our joint is easy to make and install, and it has greater flexibility. It is a rather new and effective way of joining. On the driven disk of the shaft joint are 90 stepped teeth distributed evenly on the circumference to serve concurrently as the velocimeter disk to produce feedback pulse signals which indicate the speed of rotation.

The various rotating parts of the transmission system are divided into low-speed and high-speed components. They are separately lubricated by two sets of integrated XYA-125 model oil thinning stations using lubricating oils of different densities. To improve the ability of the high-velocity gear speeder to recirculate the oil, we installed another special RCB-50 gear oil pump. We also improved the emergency high-level oil tank and made it into a pressurized oil storage tank and improved its reliability for emergency oil supply.

II. Intake and Exhaust System

During experiments with the compressor, it produced strong, loud noise. Therefore similar intake and exhaust muffler towers were built. Their structure is shown in Figure 4. The wall of the tower is a solid core brick wall of variable thickness. The surface of the bottom of the intake air tower is covered with sound-absorbing materials. Total sound insulation can reach 50 to 60 decibels, so the design of the muffler is the key to controlling noise.

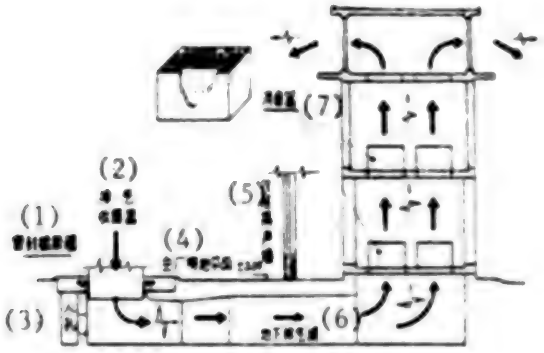

Figure 4. Illustrative Diagram of the Exhaust Channel and the Exhaust Muffler Tower

Key:

(1) Rubber sealing ring
(2) Exhaust air collector
(3) Manhole
(4) Ground surface of the main building
(5) Double layer sound insulating wall
(6) Underground exhaust tunnel
(7) Muffler

During the experiment with the compressor, the main source of noise is that due to rotation, the noise from vortex flow, and the jetting noise of the intake and the exhaust. The former two types of noise are of medium and high frequencies, and the latter type is of relatively low frequency. These three, especially the first frequency spectrum, are closely related to the compressor and its operation. Therefore, the design of the muffler is aimed at muffling noise of wide band continuous spectra. The total noise reduction by the rejection type muffler of two-section perforated plates which we designed is 30 decibels. The channel-to-area ratio of the component is 1:1. Without the rejection reducing heads at the two ends, the actual muffler element is 0.9 meter long. The perforation rate of a 1-millimeter-thick steel plate is about 4 percent. The inside is filled with ultrafine glass wool wrapped in glass fiber. The actually measured noise reduction reached the designed requirements.

The results of our sound insulation designs to muffle the noise of intake and exhaust of the entire laboratory and our designs to insulate sound in the building structure are satisfactory. The results of experiments conducted late at night showed that when the noise inside the housing reached nearly 120 decibels (A level sound), the A level noise in the residential area only a dozen meters away from the laboratory was only 51 decibels.

We know from Figure 2 that the lower limit of the allowable operating range of the experimental compressor is determined by loss due to resistance in the air duct of the intake and exhaust system. Therefore, we have included in the facility many measures to reduce flow resistance:

Larger dimensions for the intake and exhaust air ducts were used to reduce flow resistance. This also provides leeway for possible increases in the capacity of the power source.

The present intake air filter is a fine copper mesh with a layer of foam plastic 5 millimeters thick. The filter is laid flat. The results of air purification are good. We plan to change the flat mesh to a removable board to reduce flow resistance.

We lengthened the pressure expansion segment to reduce expansion loss when the air current enters the pressure stabilizer box.

The outer diameter of the box channel of the exhaust pump has been made larger (1,250 millimeters), and the axial length is taken as 1,250 millimeters. In this way, not only can we design the compressor with higher parameters by enlarging the diameter for testing, but we can also better arrange the pressure expansion channel to reduce loss. This is better for studying the single rotor compressor.

The area of the underground tunnel between the exhaust air collector and the exhaust muffler tower has been gradually expanded to reduce any increase in flow resistance brought about by each turn the air current makes in its path of flow.

The above measures were shown to be effective in actual measurements during test runs.

Besides the above characteristics, the eight blades of the exhaust throttle valves of the compressor were installed inside the eight fan-shaped channels of the frontal box of the air exhaust. This was done in an attempt to place the exhaust throttle valve relatively close to the compressor in the experimental setup of the axial compressor. This may be beneficial to controlling the operating state of the air compressor because of a reduced exhaust volume. Whether this is so and what effects this setup has on the operating characteristics of the experimental air compressor will have to be comparatively studied by experimentation.

III. Measurements and Data Collection, the Processing System, and the Operating and Control System

Measured data are the basis for analyzing the internal flow field of the compressor. Therefore, the compressor must be equipped with an advanced system of meters. According to possible conditions, we plan to set up such a system and perfect it in stages.

Pressure measurements use many pressure sensors to improve the speed of measurement. To improve the precision of measurement, besides introducing some high-precision sensors, the domestically manufactured sensors with a low precision have been carefully analyzed and calibrated. We have used computer technology to correct various types of errors so that the error of pressure measurements was kept within ±3 millimeters of the water column.

A copper resistor thermometer is used to measure the total average temperature of the air current inside the intake chamber. The sensitized element consists of copper mesh laid flat over a large area and placed on top of the first dust screen. The measurement of the temperature of the air current inside the compressor uses a copper-constantan thermoelectric coupler.

Measurement of the torque and the speed of rotation is carried out within a working range of 0 to 400 kilograms·meter and uses a 0 to 12,000 revolutions/minute phase-type rotary torque and rotary speed velocimter. The error found by stationary checks of the torque sensor at loading and unloading was ±0.1 kilograms·meter. The zero drift error at the time of load-free readjustment of the meters was within ±0.15 percent.

The data gathering system and processing system currently used convert pressure signals from various channels into electrical signals via the pressure sensor. Then, the electrical signals are fed together with the electrical signals of other parameters into the Solartron 200 dot itinerant detector. The data gathered are recorded on punched cards or fed to a Wang-2200 PCS-II small computer. The data are revised, recorded and analytically calculated by a precompiled program. The control console gives and displays the speed of rotation of the experimental compressor and automatically maintains the speed, changes the speed of rotation, changes the operating condition of the experimental compressor by regulating the opening of the intake and exhaust air throttle valves, and displays data of important monitoring positions of the various systems which have entered into relay protection series. The data gathering and processing systems will send parameters of the main operating states of the experimental compressor such as converted flow, converted speed of rotation and pressure ratio to the control console for real-time display. The control console also has a multiplex multiple function intercom so that the operator can maintain contact with related positions and record command procedures during the experiment.

The central control room also has equipment and secondary meters to monitor vibration of the equipment, stress of the blades, and radial gaps of the rotor.

To improve the speed of data gathering and processing and to realize a high degree of automation of the experimental procedures, we will soon import an American HP-1000F computer and a HP-3054A data gathering system.

This experimental setup will also use the L2F4000 laser dual-focal-point velocimeter manufacted by West Germany's Polytec Company to measure the inner velocity field of the rotor channel. This velocimeter was designed especially for testing vane wheel machinery. It can trace the rotation of vane wheels and carry out continuous automatic measurement of as many as 32 measuring points between two blades. It uses a combination of several microprocessors to control and manage the laser and the data processor. The precision of velocity measurements is better than 1 percent and the directional precision is better than 0.5°. The phase shift mechanism driven by the stepping motor can rapidly and accurately change the position of the axial and radial measuring points. The optical window on the casing of the machinery allows cleaning of the parts during the course of the experiment to assure reliable measurements. Its operating and control console is situated in the central control room.

The transonic single and double stage axial compressor testing facility built by the Engineering Thermophysics Institute was evaluated jointly by the Chinese Academy of Sciences and the First Ministry of Machine Building in June 1981. It will be a forceful tool in basic experimental research in transonic compressors. It will serve in exploring the pattern of internal flow of compressors and in developing the ternary flow theory of vane wheel machinery.

9296
CSO: 4008/95

AUTHOR: CHEN Teluan [7115 3676 7019]

ORG: South China Institute of Technology

TITLE: "Simulation of Combustion Process of the Medium Speed Diesel Engine"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 1-9

TEXT OF ENGLISH ABSTRACT: This article is a part of the author's research work done at Trondheim University, Norway. It describes a simulating model of the combustion process of the medium speed diesel engines based on the monosized droplet combustion theory to predict the variations of gas pressure, temperature and heat release rates. Comparing the calculating results with the measured data from a couple of medium speed diesel engines, we find that the results obtained from the model are quite accurate, quick and simple, and can be considered as a starting foundation for further research.

AUTHOR: ZHU Shilu [2612 1102 6922]
NI Hanning [0242 3352 1380]

ORG: ZHU of Shanghai Jiaotong University; NI of Henan Diesel Works

TITLE: "Effect of the Inlet Flow Distortion in a Centrifugal Compressor on the Crack of Inducer Blades"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 10-19

TEXT OF ENGLISH ABSTRACT: This paper deals with the exciting source of vibration which leads to crack the inducer blades of a turbocharger. The described testing method and results concerning this problem show that at the outlet section of the inlet port there is a circumferential total pressure distortion which is the exciting source of vibration that leads the resonating inducer blades to crack. A secondary flow model is proposed to explain the cause of the formation of that distortion. Several kinds of inlet port, including some vortex generators, have been tested in order to reduce the distortion. Through these experiments an improved inlet port design which can cut down the amplitude of distortion to 13.2 percent of its original value has been found.

AUTHOR: DONG Yaoqing [5516 2556 3237]
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ORC: All of the Dalian Diesel Locomotive Research Institute

TITLE: "The Design and Research Work on Increasing the Fatigue Life of the Fuel Injection Pump Cam for High Rated Diesel Engines"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 20-27

TEXT OF ENGLISH ABSTRACT: This article deals with the fatigue life of the fuel injection pump cam for high rated diesel engines by means of the classical Hertz theory together with the newly developed elastohydrodynamic theory. Studying the effects of some designing and operating parameters on Hertz pressure and oil film thickness, it points out that the increment of the equivalent radius of the cam curvature as large as possible is very significant to the decrement of its fatigue. Therefore, a fuel injection pump cam with a high fatigue life can be computer-aided design under the consideration of secondary injection, cavitation and reliability of the fuel injection system and the performance of the engine as well.

AUTHOR: CHEN Boxian [7115 0130 6343]

ORG: Shanghai Internal Combustion Engine Research Institute

TITLE: "The Design Calculation and Improvement of Thin-walled Bearing Shells"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 28-36

TEXT OF ENGLISH ABSTRACT: At the present, the result of the analysis of elastic theory in interference fit between two circular tubes of infinite length is still used in designing thin-walled bearing shells. However, as the ratio of thickness to diameter of bearing shells gets smaller, it becomes rougher for bearing shells and design and for its ineffectiveness analysis. This paper presents the equations to calculate the stresses and strains of the bearing shell treated as a thin-walled elastic composite curved plate under frictional force. These equations may be used as a foundation for design calculation and ineffective phenomena analysis of the bearing shells.

AUTHOR: WANG Ziyan [3769 1311 1693]
JIANG Deming [5592 1795 2494]

ORG: Both of Xi'an Jiaotong University

TITLE: "The Tensiometric Microprobe for Unsteady Flow Velocity Measurement and Its Applications to the Internal Combustion Engine"

SOURCE: Shanghai NEIRANJI GONGCHENG [CHINESE INTERNAL COMBUSTION ENGINE ENGINEERING] in Chinese No 1, 1982 pp 43-51

TEXT OF ENGLISH ABSTRACT: This paper describes the experience of development in the tensiometric microprobe with a dynamic pressure pick-up sheet for unsteady flow velocity measurement and gives the experimental results of the air flow velocity in the intake manifold and the velocity distribution in the swirl combustion chamber of a motored single-cylinder diesel engine with bore and stroke of 95 and 115 mm respectively.

9717
CSO: 4009/292

AUTHOR: MA Yunjie [7456 0061 2638]

ORG: None

TITLE: "The XZ-1 Type UHF Selector"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Shanghai Radio Plant No 18 has successfully made the Feiyao Brand XZ-1 model UHF selector. It has been produced in batches and placed in the market for sale. The selector is composed of the 2 parts of a boxed unit and a loop antenna. In the unit, there is an independent stable voltage power source. It has 13-48 operating channels and can convert UHF signal frequencies into the frequency of the VHF channel No 12; therefore, it can extend the reception of various types of television sets of 1-12 VHF channels to include the 13-48 UHF channels. The selector should be placed in the front or side of the television set and be plugged into the external antenna receptor. The loop antenna may be rotated to adjust the direction of the selector in order to obtain clear pictures and pleasing sound.

AUTHOR: MA Yunjie [7456 0061 2638]

ORG: None

TITLE: "The CS-2 Digital Fathometer"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Shanghai Ultrasonic Wave Instrument Plant has successfully made a new type digital depth-sounder for boat use. After technical certification and test application for several thousand km of navigation by Dongfanghong Ships No 403 and 404, the instrument has been proved to have reliable properties. The display is clear, the operation is convenient, and it is useful for promoting safe navigation. Chinese made medium scale integrated circuitry and transistors are used in the instrument. Compared with the old fathometers, it is smaller, lighter, more sensitive, and it consumes less power and has an automatic warning system. It is designed for use in inland rivers, deep lakes, and the coastal sea for measuring the water level.

AUTHOR: LIN Fu [2651 2105]

ORG: None

TITLE: "China's First 480-Path Pulse Code Modulation Multiplex Equipment"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: Not long ago, the Research Institute of Laser Communications, Wuhan Academy of Sciences, the Ministry of Post and Telecommunications successfully made the 480-path (34 Mb/s) pulse code modulation multiplex equipment, which is the major component of the digital communication series equipment. It may be used as the terminal in optical communication, microwave communication, coaxial cable, etc. digital transmission systems. It may be divided into the 4 parts of the dispatcher (multiplexor,) the receiving part (the separate connector,) the monitor shared by the dispatcher and the receiver (alarm system) and the power source. The various electrical properties have been found to meet the related regulations of the CCITT and its stucture has been found to be reasonable.

AUTHOR: ZHENG Yaolin [6774 5069 2651]
HOU Jiayin [0186 0857 7113]

ORG: None

TITLE: "Shaanxi Color Kinescope Plant Has Begun to Supply Domestic Television Plant With Qualified Picture Tubes"

SOURCE: Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 3, 15 Mar 82 p 8

ABSTRACT: After 2 years and 8 months of intense work, Shaanxi Color Kinescope Plant has produced the first batch color picture tubes on 14 Oct 81. Small scale production of the picture tube began in late Dec for supplying the 21 television plants in Beijing, Shanghai, Tianjin, Sichuan, Zhejiang, Jiangsu, Fujian, and Shaanxi. The quality of the picture has been certified to be at the advanced level of similar products of Japanese plants. According to the plan, by October this year, the picture tubes will be produced in large quantities, i.e. 960 thousand 14-inch and 22-inch color picture tubes a year, to guarantee the needs for assembling color television sets of the entire country. There will be no need to import color picture tubes any more.

6248
CSO: 4009/290

AUTHOR: YU Xiaoqin [0205 5135 3830]

ORG: None

TITLE: "The Editorial Committee of YEYA YU QIDONG Held an Expanded Conference in Shanghai"

SOURCE: Beijing YEYA YU QIDONG [HYDRAULICS AND PNEUMATICS] in Chinese No 1, 15 Mar 82 p 60

ABSTRACT: The Editorial Committee of the journal held an expanded standing committee conference in Shanghai on 1-4 Dec 81. Participants included the members of the standing committee of the editorial committee and those members of the editorial committee who were in Shanghai. There were a total of 17 persons attending. The work of the editorial department in 1981 was reported and examined and measures for improving the editorial work and the quality of the journal were suggested. The policies and goals of the journal were reviewed and the essentials to be reported in 1982 were checked. The participants all affirmed the achievement of the editorial department in 1981 while, at the same time, proposed some concrete measures to improve the quality of the journal as well as the editorial work. In 1982, the contents proposed by the All Member Conference of the Editorial Committee will remain the essentials while at the same time activities of the Chinese Agricultural Machinery Society, the Chinese Mechanical Engineering Society Hydraulics and Pneumatics Specialty Committee, and the National Hydraulic and Pneumatic Standardiza-

[continuation of YEYA YU QIDONG No 1, 1982 p 60]

tion Technological Committee and papers concerning standardization, hydraulic movement machines, hydraulic and pneumatic equipment used in departments of light industries and textiles, etc. and self-designed products will also be presented. In a very uplifted spirit, all participants resolved to continue to contribute to improving the quality of the journal and to promoting continuous development of hydraulic and pneumatic technology of China.

AUTHOR: XUE Nong [1331 6593]

ORG: None

TITLE: "First Successful Use of Cone Valve Type Hydraulic Integrated System in Large Arc Furnace"

SOURCE: Beijing YEYA YU QIDONG [HYDRAULICS AND PNEUMATICS] in Chinese No 1, 15 Mar 82 p 64

ABSTRACT: The cone valve (insert valve, logic valve) is a new hydraulic control component. In foreign countries, it was developed in the 70's and has been applied in forging press, plastics machines, etc. In 1980, a cone valve integrated system was developed for the 2 electric arc furnaces of Shangang X Plant, a steel mill. The system was jointly designed by Shanghai Academy of Metallurgical Design, Shangang X Plant, and Beijing Metallurgical Hydraulics Machinery Plant. The arc furnace was manufactured by Xian Electrical Furnace Plant. Most recently, the system was further improved. It will soon undergo certification by the state before this new technology can be extended to improve the technical level of China's metallurgical equipment.

6248
CSO: 4009/291

AUTHOR: ZHENG Diji [6774 5530 1015]
FU Chongyue [0265 1504 6141]

ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Equilibrium Study on the Lead-Chloride Ion-water System at High Ionic Strength and Elevated Temperatures"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 1-9

TEXT OF ENGLISH ABSTRACT: According to the method proposed in the authors' previous works and the equilibrium constants of the complex formation reactions measured by one of the authors, equilibria in the lead-chlorid ion-water system at high ionic strength (I=5) and elevated temperatures (25~75°C) have been studied. In particular, the E-log[Cl^-] diagram and the derived solubility curves of lead chloride as well as its characteristics during the crystallization on cooling are analyzed and discussed in detail, with a series of useful expressions being deduced.

AUTHOR: ZHENG Diji [6774 5530 1015]

ORG: Department of Nonferrous Metallurgy

TITLE: "Equilibrium Constants for the Formation Reactions of Lead (II)-Chloro Complexes"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 10-15

TEXT OF ENGLISH ABSTRACT: In order to provide fundamental data for the thermodynamic analysis of reaction systems involved in hydrometallurgy of lead, equilibrium constants for the formation reactions of lead (II)-chloro complexes at high ionic strength (I=5) and elevated temperatures have been determined by using potentiometric methods. The values of equilibrium constants at different temperatures are as follows: $K_1 = 10^{1.28}$, $K_2 = 10^{1.75}$, $K_3 = 10^{2.12}$, $K_4 = 10^{1.5}$, at 25°C; $K_1 = 10^{1.44}$, $K_2 = 10^{1.91}$, $K_3 = 10^{2.26}$, $K_4 = 10^{1.65}$, at 50°C; $K_1 = 10^{1.56}$, $K_2 = 10^{2.04}$, $K_3 = 10^{2.38}$, $K_4 = 10^{1.85}$, $K_5 = 10^{1.24}$, at 75°C.

AUTHOR: MEI Guanggui [2734 0342 6311]
ZHONG Zhuqian [6945 4554 0167]

ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Theoretical Analysis of Process of Zinc Calcine Hot Acid Leach"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 16-23

TEXT OF ENGLISH ABSTRACT: The potential pH diagrams for magnetite-water and zinc ferrite-water systems at 25°C and 100°C have been constructed, by which we can explain thermodynamically the experimental result of zinc calcine hot acid leach, i.e., high temperature (1100°C) zinc calcine is much easier to leach than ordinary zinc calcine. The kinetic factors influencing zince ferrite acid dissolution are also analyzed. In addition, the capacities of acid addition for Goethite and Jarosite processes are interpreted.

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ORG: All of the Department of Nonferrous Metallurgy

TITLE: "Preliminary Investigation of the Digestibility of Pingguo Bauxite"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 24-30

TEXT OF ENGLISH ABSTRACT: Pingguo bauxite is a kind of diasporic ore. It contains high iron oxide, most of which is present as geothite. Some influencing factors on the extraction of aluminum oxide from Pingguo bauxite were investigated. In order to compare the digestibility of Pingguo bauxite with that of some other main domestic deposits, digestion tests were carried out under the same conditions. The characteristics of these ores were also studied by X-ray diffraction, differential thermal analysis and infrared spectroscopy. Some samples of red mud were observed with electron microscopy. In the present paper the experimental test results and the main conclusions are given. The digestibility of Pingguo bauxite, the behavior of its geothite during digestion as well as the effects of CaO, $NaSO_4$ and NaCl as additions to the digestion liquor are also discussed.

AUTHOR: PENG Rongqiu [1756 1369 4428]
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ORG: Both of the Department of Nonferrous Metallurgy

TITLE: "Treatment of Complex Sulfide Concentrate Containing Copper, Zinc and Lead"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 31-37

TEXT OF ENGLISH ABSTRACT: All tests were made with flotation complex sulfide concentrate having the following analysis in wt-pct: 14.57 Cu, 16.52 Zn, 9.52 Pb. The roasting of this concentrate was conducted in a fluidized bed roaster with a bed area of 0.2 M^2. Experimental results showed that the minimum superficial gas velocity for normal fluidization was more than 1.1 $m.s^{-1}$ at 800°C. Based on this experimental data the equilibrium gas composition for oxidizing and sulfatizing roasting of this concentrate was calculated. The principal flowsheet of hydrometallurgy and direct smelting for treating this complex sulfide concentrate was also proposed.

AUTHOR: TONG Ziqi [4547 1311 6936]
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CAI Qiang [5591 1730]
JIANG Cixue [5592 2945 7185]
XIA Changqing [1115 7022 3237]

ORG: TONG, WANG, WEI and GUO all of the Department of Basic Courses; TIAN, CAI, JIANG and XIA all of the Department of Metal Materials

TITLE: "The Study of Effects of Antimony and Rare-earth Elements on the Structure and Fracture Toughness K_{IC} of ZL104 Al-Si Alloy Castings"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 38-43

TEXT OF ENGLISH ABSTRACT: This paper studies the effects of adding antimony and rare-earth elements on the structure and fracture toughness of ZL104 Al-Si alloy castings. Specimens of 20 x 40 x 200 mm with fatigue pre-cracking fracture toughness test were used for single edge notched three point loading test. The test results showed that adding the proper amount of antimony enabled the grain structure to become fine and improved the fracture toughness and other mechanical properties.

AUTHOR: LI Juexin [2621 6030 2450]

ORG: Department of Mining and Mineral Engineering

TITLE: "A Study of Different Types of Disturbances of Inertial Vibratory Drawing Ore Machines"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 44-48

TEXT OF ENGLISH ABSTRACT: The present article analyzes the mechanical behavior of vibrating drawing ore machines driven by uniaxial, biaxial, triaxial and four-axial vibrators, points out their advantages and disadvantages and puts forward some principles of their use and design.

AUTHOR: MENG Shuqing [1322 2579 7230]
HUANG Yanzhu [7806 3508 3796]
HE Zhiquan [0149 1807 2938]

ORG: MENG and HUANG both of Central South Institute of Mining and Metallurgy; HE of the Guangxi Metallurgical Research Institute

TITLE: "The Effect of Sodium Carboxymethyl Cellulose on Flotation Separation of Lead and Zinc Minerals"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 49-55

TEXT OF ENGLISH ABSTRACT: In this paper, the effect of sodium carboxymethyl cellulose (CMC) on flotation separation and wettability of galena and sphalerite is described. It has been experimentally proved that CMC depresses sphalerite and galena which are not activated by metal cations, while butyl xanthate is used as a collector at pH 11.5+, and CMC does not depress sphalerite once activated by Cu^{2+}, but depresses galena efficiently. A concentrate with a galena of 71.01 percent lead and recovery of 90.9 percent can be obtained after flotation separation when a synthetic mixed mineral contains 42.95 percent lead.

AUTHOR: None

ORG: The Experiment Group of Blind Raise*

TITLE: "The Determination of the Suitable Interval of Millisecond Initiation in Driving Blind Raise Using Longholes"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 56-62

TEXT OF ENGLISH ABSTRACT: This paper describes a particular method in which a rail is impacted by blasted rock fragments for measuring the falling time in the vacant cavity formed by blasting, and this method is used as a base for determining the suitable interval of millisecond initiation of the individual hole.

This paper also analyzes the effect of the "Complementary Space" formed by uncharged large holes or vacant cavities by blasting on the determination of the interval.

Finally, the proper delay tag number of millisecond detonator is chosen for the individual holes. This, consequently, assures the satisfactory effect in the driving of blind raise using longholes.

* Made up of individuals from the Taolin Lead and Zinc Mine, Hunan Metallurgical Research Institute and Central South Institute of Mining and Metallurgy.

AUTHOR: GAO Yunzhang [7559 0061 4545]
WU Jingu [0702 0093 6253]

ORG: Both of the Department of Mechanical Engineering

TITLE: "Optimization of the Counterweight Balancing Mechanism of Two-roll Tube Cold Rolling Mills"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 63-69

TEXT OF ENGLISH ABSTRACT: This paper describes the formulation of the optimization of the counterweight balancing mechanism of two-roll tube cold rolling mills, and applies the Complex Method to optimize the balancing mechanism of the tube cold rolling mill, model LG-30III. The computer output shows that with the optimum parameters the balance effect of the balancing mechanism rises markedly.

AUTHOR: CHEN Zeren [7115 3419 0088]

ORG: Department of Mechanical Engineering

TITLE: "Some Applications of Rotational Transformation Tensor to Descriptive Geometry"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 70-78

TEXT OF ENGLISH ABSTRACT: In this paper the following are discussed: how to solve the problems of the lines of intersection between a plane and the surface of a solid of revolution and between the surfaces of solids of revolution; and how to solve the problem of the development of the surface by means of rotating transformation tensor. In the paper a typical example of how to get the solution to a problem with optimization and through a computer's supplementary calculus is also given.

AUTHOR: ZHOU Zixing [0719 2737 2502]

ORG: Department of Geology

TITLE: "Reliability Processing of Residual Magnetic Anomaly"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 79-86

TEXT OF ENGLISH ABSTRACT: First this paper analyzes the correlation of the false component (ΔZ_A) in residual magnetic anomaly (ΔZ) to theoretical anomaly by given bodies. Second, a function Z_f can be made in accordance with the property of ΔZ_A. Additionally, Z_f can be computed by changing the factors in the function so as to make Z_f approximate to ΔZ in the domains of space, the wave number and the space-wave number respectively.

The advantages of this method are that the properties of both space-domain and wave number-domain can be used, and that the method to figure the reliability coefficients may be given.

AUTHOR: HUANG Jianchao [7806 0256 6389]
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SUN Xiaohua [1327 1321 5478]
LI Shutang [2621 2885 2768]

ORG: All of the Department of Metal Materials

TITLE: "Metallographic Observation of Thermoelastic Martensitic in Cu-Al-Ni Alloys"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 87-94

TEXT OF ENGLISH ABSTRACT: The transformation points of martensite in Cu-14 percent Wt Al-4.2 percent Wt Ni alloy (M_s, M_f, A_s, A_f) have been measured. The microscope thermoelastic martensite transformation of this alloy under a high temperature has been observed. According to the experimental phenomenon which appeared in the transformation process, some views on the formation and figure of martensite are posed.

AUTHOR: DING Daoyun [0002 6670 0061]
ZHANG Daquan [1728 6671 2938]

ORG: DING of the Central South Institute of Mining and Metallurgy; ZHANG of the Hunan Computing Technology Research Institute

TITLE: "Calculation of the Rare Earth and Transition Metals Phase Diagrams--Calculation of Binary Systems: Y-Zr and Y-Hf"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 95-101

TEXT OF ENGLISH ABSTRACT: According to the regular solution approximation, the binary phase systems of rare earth (yttrium) and refractory transition metals (zirconium and hafnium) are calculated by the use of Kaufman's method. The calculated phase diagrams are compared with the experimental ones, and they are found to be in good agreement.

AUTHOR: RUI Jiagao [5360 0857 6138]

ORG: Department of Basic Courses

TITLE: "The Non-stability for a Class of Integral-Differential Equations with Infinity Delays"

SOURCE: Changsha ZHONGNAN KUANGYE XUEYUAN XUEBAO [JOURNAL OF CENTRAL SOUTH INSTITUTE OF MINING AND METALLURGY] in Chinese No 4, Dec 81 pp 102-108

TEXT OF ENGLISH ABSTRACT: In this paper we have made a study of the solution of a class of the integral-differential equations with infinity delays by means of the V-functional method and have obtained sufficient conditions of non-stability of zero solution.

9717
CSO: 4009/287

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ZHANG Hong [1728 1347]
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HU Suhui [5170 4790 6540]

ORG: All of the Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "An Investigation of Nb_3Sn Multifilamentary Superconducting Composites Formed from High-tin-concentration Cu-Sn Alloy"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 1, 1982 pp 17-25

TEXT OF ENGLISH ABSTRACT: By the use of Nb tubes and Sn-Cu alloy, two Nb Sn multifilamentary superconducting composites with 33 and 55 filaments respectively have been fabricated by the internal diffusion method. An investigation has been made on the influences of the different Nb_3Sn reaction diffusion treatments (600°C to 800°C, 1 to 250 hr) and of the additive In on Nb_3Sn layer-thickness growth, grain size and superconducting properties. Experimental results indicate that the stepped-rising temperature treatment is advantageous to the reduction of grain size, and that the ratio of Nb_3Sn layer-thickness growth rate to grain size growth rate is increased by the additive In. Overall current density of $Nb_3(Sn\ In)$ composite with 55 filaments J_c (4.2 K, 6 T) is about 7.3×10^4 A cm^{-2}.

AUTHOR: MENG Xiaofan [1322 1420 0416]
LI Bo [2621 3134]
BAO Keqin [0545 0344 0530]

ORG: All of the Physics Department, Beijing University

TITLE: "Studies on the Fabrication Technology of Lead Josephson Tunnel Junctions Formed by Thermal Oxidation in High Purity Oxygen"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 1, 1982 pp 26-33

TEXT OF ENGLISH ABSTRACT: This paper principally presents the fabrication procedures of lead Josephson tunnel junctions formed by thermal oxidation in high purity oxygen and reports some experimental results. The junctions formed by this method have high quality, high yield rate and good homogeneity and reproducibility of critical currents. The paper also presents some examination methods of the oxide quality [illegible] tunnel junctions.

AUTHOR: LI Jiazhang [2621 0857 3864]
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TITLE: "Experimental Study of the Variation of the Critical Current of the Tunnel Junctions with the External DC Magnetic Field"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 34-41

TEXT OF ENGLISH ABSTRACT: Because the critical current of Josephson tunnel junctions is highly sensitive to the magnetic field, the field can be used to examine the quality of the tunnel junctions. This paper describes an apparatus which measures the variation of the critical current of the tunnel junctions I_c with the external DC magnetic field. The relation between I_c and H is directly shown on an X-Y recorder. The examination results for junctions of different sizes are obtained and discussions are briefly given.

AUTHOR: None

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TITLE: "An Experimental Study of Quenching Dynamic Processes of the Unpainted NbTi Composite"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 42-50

TEXT OF ENGLISH ABSTRACT: A study on quenching dynamic processes of the unpainted NbTi composite is made by using the double-solenoid method, obtaining the minimum trigger energy ε_m, the propagation velocities of the normal zone for various biasing magnetic fields in operating currents as well as the parameters I_m, I_p and I^*. The paint film is found to have a marked effect both on the configuration of the volt-ampere characteristics of quenching processes and the characteristic parameters. When the intensity of heat evolution is greater than a certain critical value, a change of propagation is shown in the normal zone from that of one dimension to that of two dimensions.

The double-solenoid method proves practicable in predicting the operation characteristics of the composites, in choosing the working points of the large magnets, and

[Continuation of DIWEN WULI No 1, 1982 pp 42-50]

in making analyses of the stability against the local heat pulses. Therefore, the method is worth being popularized for the regular tests of the performance of superconducting materials.

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TITLE: "Experimental Investigation of an Iron-core Superconducting Solenoid"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 56-64

TEXT OF ENGLISH ABSTRACT: A summmary is made of the experimental results of an iron-core superconducting solenoid with high current density and high field. The tested solenoid has a bore diameter of 400 mm, stored energy of 0.445 MJ and a peak field of about 5 T. The results show clearly that the iron core has the effects of reducing the peak field, increasing the central field and improving field homogeneity and that the winding critical current has also been raised.

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TITLE: "Ultimate Critical Current Density of Nb_3Al, $Nb_3(AlGe)$ and $V_4(HfZr)$"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 74-77

TEXT OF ENGLISH ABSTRACT: By applying a flux pinning theory, where the ultimate critical current density (J_c) of a superconductor is determined by plastical shearing of flux line lattice, approximate upper limits on J_c of Nb_3Al, $Nb_3(AlGe)$ and $V_4(HfZr)$ are estimated and compared with those of other high-magnetic-field superconductors. Results show that the upper limits on J_c of Nb_3Al are the greatest for magnetic field $B < 26$ T, but $Nb_3(AlGe)$ has the highest upper limit on J_c for 26 T $< B <$ 38 T. We conclude that Nb_3Al and $Nb_3(AlGe)$ are the best potential superconductors in high magnetic field applications.

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TITLE: "A New Portable Auto-transfer Equipment for Cryo-liquids"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 86-88

TEXT OF ENGLISH ABSTRACT: A new portable auto-transfer equipment for cryo-liquids which we designed is described in this paper. It can transfer the liquids by means of only the pressure produced due to evaporation of the liquid itself without both the power supply and the source of high pressure gas. Its weight is 2.5 kg in all, and the structure is very simple and ingenious. The main part includes three dynamic valves and an evaporation chamber. It has been successfully used to transfer liquid nitrogen, liquid hydrogen and liquid air on a small scale from a Dewar vessel to the cooling apparatus in the fields of low temperature physics, cryo-electronics and infrared techniques.

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TITLE: "Measurement of Superconducting Critical Field in High Pulsed Magnets"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURA HUMILIS SINICA] in Chinese No 1, 1982 pp 89-92

TEXT OF ENGLISH ABSTRACT: The critical field of superconducting wire has been measured. The resistive critical field Hr of NbTi alloy wire is found to be 115 ± 4 kg at 4.2 K. Observations have also been made on the effect of noise, Joule heating and "critical current" on the critical field measurement. One of the high pulsed magnets used can produce the field higher than 400 kg with a pulsed duration of 15.6 msec, and the efficient inside diameter is 25 mm.

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